

AD A109164

OHIO RIVER BASIN
TRIBUTARY SALTICK RUN, FAYETTE COUNTY

①

PENNSYLVANIA

PATSY'S LAKE DAM

NDI ID NO. PA-565

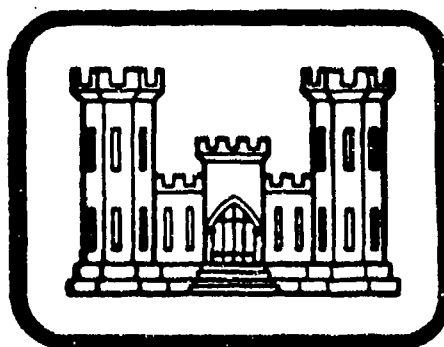
DER ID NO. 26-5

LEVEL II

PASQUALE CARBONARA

PHASE I INSPECTION REPORT

(16) NATIONAL DAM INSPECTION PROGRAM



DTIC
ELECTE
JAN 04 1982
S D E

DTIC FILE COPY

(10) R. Jeffrey / Kimball

Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

*Original contains color
plates. All DTIC reproductions
will be in black and
white.

FOR
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

JUNE, 1981

This document has been approved
for public release and sale; its
distribution is unlimited.

81 12 28 201

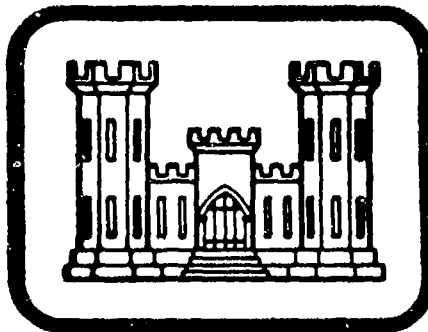
444059 sk

OHIO RIVER BASIN
TRIBUTARY SALTICK RUN, FAYETTE COUNTY

PENNSYLVANIA
PATSY'S LAKE DAM

NDS ID NO. PA-000
DER ID NO. 26-104

PASQUALE CARBONARA
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DACW31-81-C-0012

Prepared By
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

JUNE, 1981

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Accession For	
NTIS GFA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification <i>On file</i>	
By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or Special
<i>A</i>	

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Patsy's Lake Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Fayette
STREAM	Tributary to Saltlick Run
DATES OF INSPECTION	November 6, 1980 and May 12, 1981
COORDINATES	Lat: 39° 57' Long: 79° 48.5'

ASSESSMENT

The assessment of Patsy's Lake Dam is based upon visual observations made at the time of inspection, hydraulic and hydrologic computations and past operational performance.

The Patsy's Lake Dam appears to be in poor condition. The entire downstream slope of the dam is heavily vegetated. A portion of the downstream slope had been cleared, as observed during the May 12, 1981 inspection. The brush and small trees are being cut by the owner in an uncontrolled manner.

→ The potential for erosion of the downstream slope of the dam exists. Potential erosion exists due to occasional pumping of reservoir water to supply water to a coal cleaning plant located near the dam. The water supply line has broken in the past, causing significant erosion to the downstream slope. The location of the pumping facilities is considered a deficiency. The pump and line should be relocated to an acceptable location.

→ A wet area was observed near the left abutment of the dam. It appeared as though the wet area was due to surface runoff from the left abutment. Water should be diverted away from the left abutment, and the wet area monitored.

→ Dense vegetation exists in the spillway discharge channel. The dense vegetation could retard flow in the channel. The channel should be better defined, and erosion protection provided to protect the downstream slope of the embankment from erosion due to spillway discharges.

→ The Patsy's Lake Dam is a high hazard-small size dam. The recommended Spillway Design Flood (SDF) for a dam of this size and classification, is in the range of 1/2 PMF to PMF. Based on the downstream potential for loss of life, the spillway design flood has been selected as the PMF. The spillway and reservoir are capable of controlling approximately 12% of the PMF, without overtopping the embankment low spot. Based on criteria established by the Corps of Engineers, the spillway is termed seriously inadequate. Patsy's Lake Dam is classified as an unsafe, non-emergency structure.

PATSY'S LAKE DAM
PA 565

The following recommendations and remedial measures should be instituted immediately.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis to increase the spillway capacity. The detailed hydraulic analysis should include an analysis of the spillway discharge channel. The spillway discharge channel should be well defined, free of vegetation, and provided with sufficient erosion control measures to prevent erosion of the embankment and downstream toe of the dam.
2. The facilities located on the crest of the dam to supply water to the coal cleaning plant, located downstream of the dam, should be abandoned. If the practice of drawing water from the reservoir is continued, facilities should be provided in a location where potential breaks in the line do not allow erosion of the earthen embankment of the dam.
3. Surface runoff from the left abutment should be diverted away from the toe of the dam. Once the runoff is diverted, the area should be monitored. If the wet condition continues in the area, the condition should be evaluated by a registered professional engineer.
4. No drainline exists for the reservoir. Some means should be developed by the owner to drain the reservoir.
5. The top of dam should be filled to an elevation consistent with the entire crest.
6. The brush and small trees, located on the downstream slope of the dam, should be removed in a controlled manner, under the direction of a registered professional engineer knowledgeable in dam design and analysis.
7. A warning system should be developed to warn downstream residents of imminent failure of the dam.
8. A regularly scheduled operations and maintenance program should be planned and implemented at the dam.
9. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

PATSY'S LAKE DAM
PA 565

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

Date

JUNE 15, 1981

R. Jeffrey Kimball, P.E.

R Jeffrey Kimball

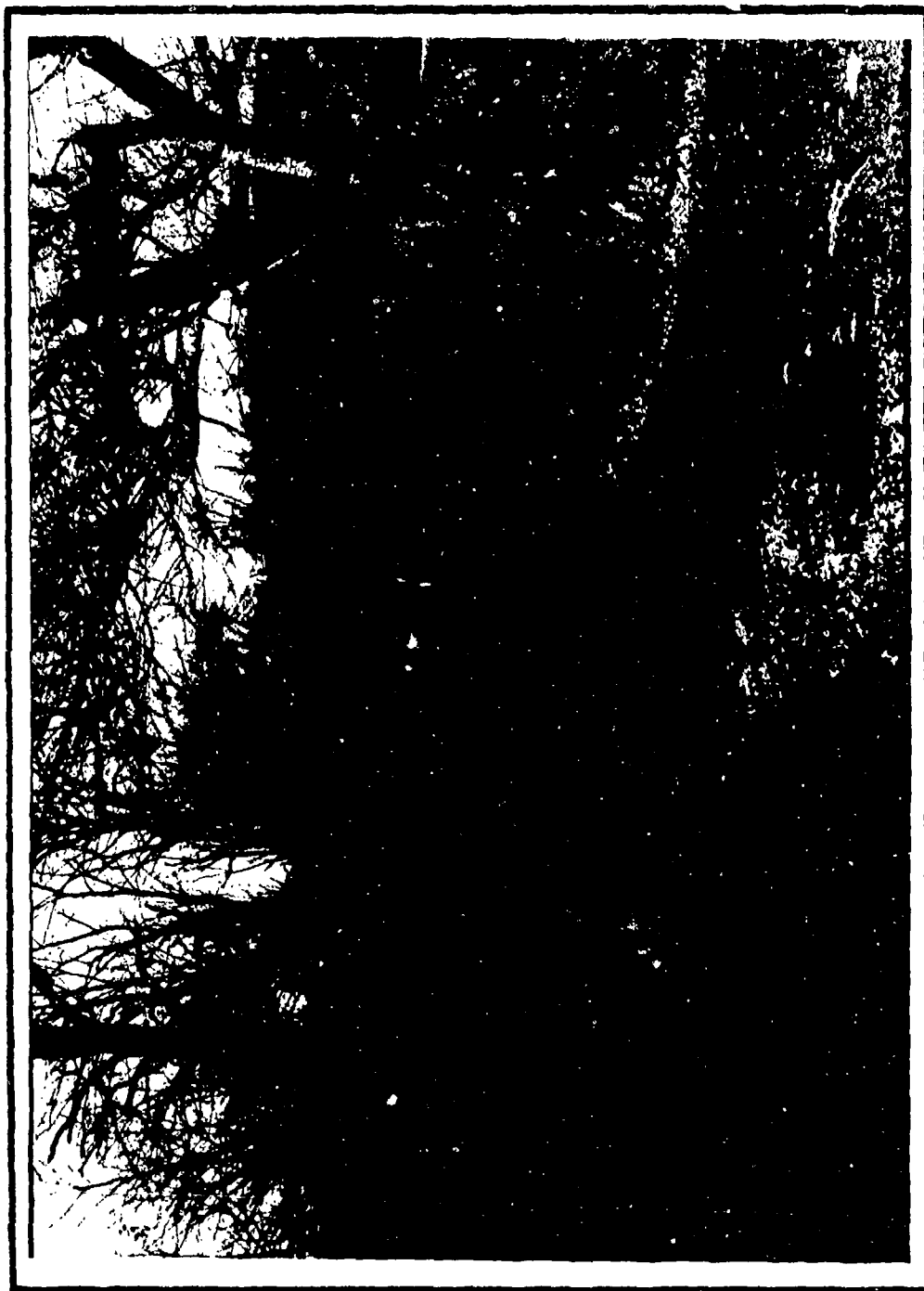
APPROVED BY:

Date

7 JUL 81

JAMES W. PECK
Colonel, Corps of Engineers
Commander and District Engineer

James W. Peck



Overview of Patsy's Lake Dam

TABLE OF CONTENTS

	PAGE
SECTION 1 - PROJECT INFORMATION	1
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	2
SECTION 2 - ENGINEERING DATA	4
2.1 Design	4
2.2 Construction	4
2.3 Operation	4
2.4 Evaluation	4
SECTION 3 - VISUAL INSPECTION	5
3.1 Findings	5
3.2 Evaluation	6
SECTION 4 - OPERATIONAL PROCEDURES	8
4.1 Procedures	8
4.2 Maintenance of Dam	8
4.3 Maintenance of Operating Facilities	8
4.4 Warning System in Effect	8
4.5 Evaluation	8
SECTION 5 - HYDRAULICS AND HYDROLOGY	9
5.1 Evaluation of Features	9
5.2 Evaluation Assumptions	9
5.3 Summary of Overtopping analysis	9
5.4 Summary of Dam Breach Analysis	10
SECTION 6 - STRUCTURAL STABILITY	11
6.1 Evaluation of Structural Stability	11
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES	13
7.1 Dam Assessment	13
7.2 Recommendations/Remedial Measures	14

APPENDICES

- APPENDIX A - CHECKLIST, VISUAL INSPECTION, PHASE I
- APPENDIX B - CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION,
OPERATION, PHASE I
- APPENDIX C - PHOTOGRAPHS
- APPENDIX D - HYDROLOGY AND HYDRAULICS
- APPENDIX E - DRAWINGS
- APPENDIX F - GEOLOGY

PHASE I
NATIONAL DAM INSPECTION PROGRAM

PATSY'S LAKE DAM
NDI. I.D. NO. PA 565
DER I.D. NO. 26-5

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. The Patsy's Lake Dam is an earthfill dam, 470 feet long and 34 feet high. The crest width of the dam is 15 feet. The upstream slope is 4H:1V (below the waterline) to 1H:1V on the visible portion of the upstream slope. The downstream slope of the dam is 1.75H:1V, and densely vegetated. An earthen roadway exists along the entire length of the crest. A small diameter plastic pipe exists through the embankment, just beneath the crest of the dam. The plastic pipe contains a hose which is used to supply water to a coal cleaning operation located near the village of Searights. Water is pumped from the reservoir on an as-needed basis. When water is required at the cleaning operation, a pump is placed on the upstream slope of the dam.

The spillway for the dam is located at the right abutment. The spillway consists of three 18" diameter pipes. Two of the pipes are steel and the third pipe is reinforced concrete. The pipes are covered with earthfill. The upstream and downstream face of the embankment is protected with a dry masonry wall. Discharges from the spillway flow through a channel along the right abutment.

b. Location. The dam is located on a tributary to Saltlick Run, approximately 2,000 feet northeast of the Village of Searights, Menallen Township, Fayette County, Pennsylvania. The Patsy's Lake Dam can be located on the New Salem, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. The Patsy's Lake Dam is a small size dam (34 feet high, 117 acre-feet).

d. Hazard Classification. The Patsy's Lake Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives and property damage is probable should the structure fail. Several homes are located immediately downstream and beyond the toe of the dam.

e. Ownership. The Patsy's Lake Dam is owned by Mr. Pasquale Carbonara. Correspondence should be addressed to:

Mr. Pasquale Carbonara
R.D. #6 Box 380
Uniontown, Pennsylvania 15401
412/245-8257

f. Purpose of Dam. The dam is utilized for recreational purposes. The owner operates a pay fishing lake.

g. Design and Construction History. No design or construction history was available for review for this dam. The owner reported that the dam was built in the late 1800's. It was also reported by the owner that the dam was originally owned by the Republic Collieries Company. No other information is available relative to the dam.

h. Normal Operating Procedures. No operations are conducted at the dam.

1.3 Pertinent Data.

a. Drainage Area. 0.22 square mile

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Spillway capacity at top of dam	40 cfs

c. Elevation (M.S.L.) (feet). - Field survey based on an assumed spillway crest elevation, 1090 feet, interpolated from U.S.G.S. quadrangle (Sheet E-1).

Top of dam - low point	1092.6
Top of dam - design height	Unknown
Pool at time of inspection	1088.6
Spillway crest (upstream invert 18" pipes)	1090.0
Maximum pool - design surcharge	Unknown
Normal pool	1090.0
Streambed at centerline of dam	Unknown
Maximum tailwater	Unknown
Toe of dam	1058.5

d. Reservoir (feet).

Length of maximum pool	1400
Length of normal pool	1300

e. Storage (acre-feet).

Normal pool (spillway crest)	92
Top of dam	117

f. Reservoir Surface (acres).

Top of dam	10
Normal pool	9.2
Spillway crest (3 18" diameter pipes)	9.2

g. Dam.

Type	Earthfill
Length (excluding spillway)	470 feet
Height	34 feet
Top width	15 feet
Side slopes - upstream	1H:1V to 4H:1V
- downstream	1.75H:1V
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	

h. Reservoir Drain. (none)

Note: Facilities exist at the dam which provide the capability to pump water from the reservoir. The pumping facilities are not owned by the owner. Pumping occurs on an unscheduled, as-needed basis as determined by requirements of a coal cleaning plant located downstream of the dam. The pump does not remain at the dam on a continuing basis.

i. Spillway.

Type	(3) 18" diameter pipes (2 steel, 1 reinforced concrete)
Length (approximate)	20 feet
Crest elevation (assumed)	1090.0
Upstream channel	Lake
Downstream channel	Tributary to Saltlick Run

SECTION 2 ENGINEERING DATA

2.1 Design. No information was available from the Commonwealth of Pennsylvania, Department of Environmental Resources. The owner supplied a drawing to the inspection team, but only limited information was available on the drawing, and the quality of the drawing was unsuitable for supplying reproductions for this report.

2.2 Construction. No information exists regarding the construction of the dam.

2.3 Operation. No operations are conducted at the dam except occasional pumping described in paragraph 1.2a of Section 1.

2.4 Evaluation.

a. Availability. No engineering data were available for the dam. The owner of the dam, Mr. Pasquell Carbonara, was interviewed to obtain data relative to the dam. A plan view of the dam was supplied to the inspection team by the owner, but no pertinent information was obtained from the plan.

b. Adequacy. This Phase I Report is based on the visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3 VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Patsy's Lake Dam was conducted by personnel of L. Robert Kimball and Associates, accompanied by Mr. Chuck Woodward (Department of Environmental Resources), on November 6, 1980 and May 12, 1981. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in poor condition. Maintenance is considered fair. From a brief survey conducted during the inspection, it was noted that a low spot exists on the embankment crest, approximately 250 feet from the left abutment. A major erosion area was observed on the downstream slope of the dam, at the location of the plastic pipe, which exists through the embankment. The erosion was due to a break in the waterline, which is used to pump reservoir water to a coal cleaning plant, located downstream of the dam. It was noted during the May 12, 1981 inspection that the erosion area had been filled. It was reported by the owner that the erosion area was repaired by employees of the cleaning plant.

The entire downstream slope of the dam was observed to be heavily vegetated. Brush and small trees exist along the entire length of the dam, on the slope. During the May 12, 1981 inspection, it was observed that a portion of the downstream slope had been partially cleared of brush and small trees, adjacent to the right abutment.

A wet area was observed on the downstream slope of the dam, near the left abutment contact. The wet area appeared to be due to surface runoff from the left abutment. No change was observed in the area during the May 12, 1981 inspection from that which existed during the November 6, 1980 inspection.

c. Appurtenant Structures. The spillway for the dam is located at the right abutment of the structure. Three 18" diameter pipes serve as the spillway for the dam. Two of the pipes are steel, and the third pipe is reinforced concrete. The upstream inverts of the pipe were within several inches of having equal elevations. The pipes

exist in an area which was once utilized as a concrete channel spillway. Portions of the concrete approach wingwalls and concrete channel walls were visible. It was reported by the owner that the concrete spillway was filled to supply access across the dam. Three pipes were placed in the channel prior to placement of the earthfill. Dry masonry walls were placed on the upstream and downstream face of the fill.

The water level in the reservoir was observed to be at elevation 1088.6, as determined by a survey conducted during the inspection. Inflow to the reservoir is normally discharged through the three 18" diameter pipes. Flow through the spillway is discharged to an open earth cut channel, which exists along the right abutment. The spillway discharge channel was heavily vegetated. The vegetation restricts discharges in the channel. It was also observed that the location of the discharge channel was such that flow through the channel has the potential to erode the downstream toe of the dam.

d. Reservoir Area. The watershed for the dam is formed almost entirely by open fields. The reservoir slopes are moderate and do not appear to be susceptible to landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel for the Patsy's Lake Dam consists of a tributary to Saltlick Run. Several homes are located immediately beyond the downstream toe of the dam, across a township roadway. The village of Searights is located approximately 2000 feet downstream of the dam. The population of the several homes, located beyond the toe, is estimated at 6 to 10 people.

3.2 Evaluation. In general, the dam and appurtenant structures appear to be in poor condition. One major erosion area was observed during the November 6, 1980 inspection. The erosion area was observed to have been repaired, as noted during the May 12, 1981 inspection. The downstream slope of the dam was heavily vegetated. A portion of the downstream slope had been partially cleared, as noted during the May 12, 1981 inspection. The remaining brush and small trees should be cleared from the slopes in a controlled manner. It was reported by the owner that the cutting of brush and trees on the downstream slope was being performed at the owner's discretion.

The wet area observed near the left abutment contact appears to be due to surface runoff from the left abutment. The surface runoff should be diverted away from the toe of the dam. The dense vegetation in the discharge channel should be removed, so as not to restrict discharges in the channel. Erosion control measures should be utilized in the channel to prevent erosion of the downstream toe.

No drainline exists for the reservoir. Facilities exist at the dam to allow pumping of water from the reservoir on an unscheduled, as-needed basis. The pump is not at the dam on a continuing basis (See note; Section 1.3.h).

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures. Procedures at the reservoir consist of occasional pumping of water from the reservoir to a coal cleaning plant located near the village of Searights. The pumping of reservoir water is conducted by employees of the cleaning plant. No other procedures are conducted at the dam.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the dam. Maintenance of the dam is performed by the owner on an unscheduled, as-needed basis. Small trees and brush exist on the downstream slope. It was observed during the May 12, 1981 inspection that a portion of the downstream slope near the right abutment had been partially cleared of vegetation. The remaining brush and small trees should be removed from the slope in a controlled manner.

4.3 Maintenance of Operating Facilities. The pumping facilities utilized by the operators of a coal cleaning plant, located downstream of the dam, are operated on an unscheduled, as-needed basis. Maintenance of the pumping facilities are completed by the employees of the cleaning plant. No other operating facilities exist at the dam.

4.4 Warning System in Effect. There is no warning system in effect to warn downstream residents of imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam is considered fair. It was noted during the May 12, 1981 inspection, that the brush and small trees were removed from the downstream slope. Erosion noted during the November 6, 1980 inspection was reportedly repaired by employees of the coal cleaning plant, located downstream of the dam. The repair of the erosion area was requested by the owner.

Dense vegetation exists in the spillway discharge channel. The brush and small trees in the channel should be removed to allow for unrestricted flow in the channel. A potential for erosion of the downstream toe of the dam exists.

An emergency action plan should be available for every dam in the high and significant category. Such plans should outline actions to be taken by the operator to minimize downstream effects of an emergency, and should include an effective warning system. No emergency action plan has been developed.

SECTION 5 HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

- a. Design Data. No hydrologic or hydraulic design data exist.
- b. Experience Data. No rainfall, runoff or reservoir level data were available. It was reported by the owner that the dam had been overtopped during a past storm. No date was associated with the past overtopping.
- c. Visual Observations. The spillway for the dam consists of three 18" diameter pipes. Two of the pipes were steel and the third pipe was reinforced concrete. No trash rack was provided at the inlet to the pipes. Brush and debris could potentially clog the pipes. The discharge channel was densely vegetated. The vegetation restricts flow in the channel. Flow through the channel could potentially erode the toe of the dam. The low spot on the embankment crest exists approximately 250 feet from the left abutment.
- d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The pool elevation in the reservoir, prior to the storm, was assumed to be at the spillway crest elevation, 1090.0.
2. The top of dam was considered to be the low spot elevation, 1092.6.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	950 cfs
Spillway capacity	40 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) is based on the hazard and size classification of the dam. The recommended spillway design flood for a dam of this size and classification is in the range of 1/2 PMF to PMF. Based on the potential for loss of life and property damage, the spillway design flood has been selected as the PMF. Based on the following definition provided by the Corps of Engineers, the spillway is rated as seriously inadequate as a result of our hydrologic analysis.

Seriously inadequate - All high hazard dams which do not pass at least 50% of the Spillway Design Flood (PMF), and where failure of the dam significantly increases the downstream hazard to loss of life from that which existed just prior to overtopping failure of the dam.

The spillway and reservoir are capable of controlling approximately 12% of the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass at least 50% of the PMF (based on our analysis), it was necessary to perform the dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure. A pool elevation of 1092.9, which represents 0.30 foot of overtopping, was considered sufficient to cause failure of the dam due to overtopping.

The results of the dam breach analysis indicate that the downstream potential for loss of life and property damage is significantly increased by dam failure from that which existed just prior to failure of the dam. The momentum associated with the increased flow could have a devastating effect on the population downstream of the dam. Therefore, the spillway is rated as seriously inadequate. Details of the downstream routing of the flood wave are included in Appendix D.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. A major erosion area was observed during the November 6, 1980 inspection. The erosion area was observed near the location of the plastic pipe which exists through the embankment. The erosion was due to a break in the waterline, which supplies water to a cleaning plant downstream of the dam. During the May 12, 1981 inspection, the erosion area had been filled. No details were available relative to the placement of the material. The downstream slope of the dam is relatively steep (1.75H:1V). Dense vegetation exists on the downstream slope of the dam. It was noted during the May 12, 1981 inspection that a portion of the downstream slope, adjacent to the right abutment, had been cleared by the owner. No seepage was observed during either the November 6, 1980 inspection or the May 12, 1981 inspection. A wet area was observed near the left abutment of the dam, but the wet area was apparently due to surface runoff from the left abutment. No change in the wet area was observed during the May 12, 1981 inspection from that which was observed during the November 6, 1980 inspection.

The embankment slopes are oversteepened (1H:1V and 1.75H:1V). Although no signs of instability was noted, the embankment stability is uncertain.

Dense vegetation was observed in the spillway discharge channel. The vegetation has the potential to retard flow in the channel. The discharge channel is located such that flow through the channel could potentially erode the downstream toe of the dam. Erosion of the toe could lead to failure of the dam.

A plastic pipe exists through the embankment, just beneath the crest, and contains a waterline which serves to supply water to a coal cleaning plant located downstream of the dam. A past break in the line had eroded a significant portion of the downstream slope near the crest. The potential for future breaks in the line could lead to erosion of the slope, and potential failure of the structure.

b. Design and Construction Data. No information relative to the design and construction of the dam was available for review. It was reported by the owner that the dam was built in the late 1800's. A water supply line existed through the embankment. The waterline was not being used at the time the owner obtained the property. It was reported by the owner that the waterline through the embankment had been plugged with concrete. No stability analysis are on record or known to exist for the structure.

c. Operating Records. No operating records exist for the dam.

d. Post Construction Changes. It was reported by the owner that the original spillway, located at the right abutment of the dam, was filled to allow access across the dam. The original spillway consisted of a concrete channel. Prior to filling the original spillway, the owner placed three 18" diameter pipes along the channel, and covered the channel with earthfill. Dry masonry headwalls were constructed along the upstream and downstream face of the fill. No other known post construction changes were reported as having occurred at the structure.

e. Evaluation. No obvious deficiencies were observed during the inspection which were considered as having an immediate effect on the static stability of the dam. Therefore, the dam is assumed to be safe for static loading conditions.

It should be noted that mining may have occurred beneath the dam, and the owner should be aware of possible subsidence in the area of the dam and the potential effects relative to the ongoing stability of the structure.

e. Seismic Stability. The dam is located in seismic zone 1. No known seismic stability analyses have been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. The dam is assumed safe for earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in poor condition. Maintenance is considered fair. A major erosion area was observed during the November 6, 1980 inspection. The erosion area was observed approximately 300 feet from the left abutment. It was noted during the May 12, 1981 inspection that the erosion area had been repaired.

The top of dam low spot was determined to be located approximately 250 feet from the left abutment.

The downstream slope of the dam was observed to be excessively steep and heavily vegetated. A portion of the brush and small trees had been removed, as observed during the May 12, 1981 inspection. The removal of the brush and small trees is being conducted by the owner on an uncontrolled basis. A wet area was observed near the left abutment of the dam, but the wet area was apparently due to surface runoff from the left abutment.

The spillway discharge channel is densely vegetated. Vegetation in the channel could potentially retard flow in the channel. The wet area observed on the downstream slope, near the left abutment contact was apparently due to surface runoff from the left abutment. Surface runoff from the left abutment should be diverted away from the downstream slope and toe of the dam. The Patsy's Lake Dam is a high hazard-small size dam. The recommended Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. Based on the height of the dam, and downstream potential for loss of life, the spillway design flood has been selected as the PMF.

The visual observations, review of available data, hydraulic and hydrologic calculations, and past operational performance indicate that the Patsy's Lake Dam is capable of controlling approximately 12% of the PMF. The spillway is termed seriously inadequate due to significantly increased flow downstream of the dam, due to dam failure. The momentum associated with the flow during a dam failure would cause significant damage to downstream homes and the probable loss of life. The flow caused by a dam failure is significantly increased from that which would exist just prior to dam failure. The dam is classified as an unsafe, non-emergency structure.

b. Adequacy of Information. Sufficient information is available to complete a Phase I report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis to increase the spillway capacity. The detailed hydraulic analysis should include an analysis of the spillway discharge channel. The spillway discharge channel should be well defined, free of vegetation, and provided with sufficient erosion control measures to prevent erosion of the embankment and downstream toe of the dam.

2. The facilities located on the crest of the dam to supply water to the coal cleaning plant, located downstream of the dam, should be abandoned. If the practice of drawing water from the reservoir is continued, facilities should be provided in a location where potential breaks in the line do not allow erosion of the earthen embankment of the dam.

3. Surface runoff from the left abutment should be diverted away from the toe of the dam. Once the runoff is diverted, the area should be monitored. If the wet condition continues in the area, the condition should be evaluated by a registered professional engineer.

4. No drainline exists for the reservoir. Some means should be developed by the owner to drain the reservoir.

5. The top of dam should be filled to an elevation consistent with the entire crest.

6. The brush and small trees, located on the downstream slope of the dam, should be removed in a controlled manner, under the direction of a registered professional engineer knowledgeable in dam design and analysis.

7. A warning system should be developed to warn downstream residents of imminent failure of the dam.

8. A regularly scheduled operations and maintenance program should be planned and implemented at the dam.

9. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Patsy's Lake Dam COUNTY Fayette STATE Pennsylvania ID# PA 565

TYPE OF DAM Earthfill November 6, 1980 Clear and cool HAZARD CATEGORY High

DATE(S) INSPECTION May 12, 1981 Clear and warm TEMPERATURE 40°
60°

POOL ELEVATION AT TIME OF INSPECTION 1088.0 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockenamirh - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

Mr. Chuck Woodward - Pennsylvania Department of Environmental Resources - Carnegie Regional Office

O.T. McConnell RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Major erosion area observed on the downstream slope of the dam during the November 6, 1980 inspection.	The erosion had been repaired, as observed during the May 12, 1981 inspection.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appears to be all right, except for a low spot located approximately 250 feet from the left abutment.	The top of dam should be filled to an elevation consistent with the entire crest.
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Brush and small trees exist on the downstream slope of the dam. The brush and trees should be removed in a controlled manner.	A portion of the downstream slope, near the right abutment, had been partially cleared by the owner.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be all right.	
ANY NOTICEABLE SEEPAGE	No seepage was positively identified during either inspection. A wet area was observed near the left abutment contact. The wet area appears to be due to surface runoff from the left abutment.	The runoff should be diverted away from the embankment. Once the runoff is diverted, the wet areas should be monitored.
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Not applicable.	
OUTLET STRUCTURE	Not applicable.	
OUTLET CHANNEL	Not applicable.	
EMERGENCY GATE	Not applicable.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Not applicable.	
APPROACH CHANNEL	Lake.	
DISCHARGE CHANNEL	Tributary to Saltlick Run. Heavy brush and trees exist in the discharge channel.	The debris should be removed from the spillway discharge channel, and the channel better defined.
BRIDGE AND PIERS	None.	Erosion control should be provided in the channel to protect the earthen embankment.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL.	Not applicable.	
APPROACH CHANNEL.	Not applicable.	
DISCHARGE CHANNEL.	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The spillway discharge channel for Patsy's Lake Dam consists of a tributary to Saltlick Run. Heavy brush exists in the discharge channel.	Brush and debris should be removed from the channel.
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Several homes are located immediately beyond the downstream toe of the dam, across a township roadway the population of the several homes is estimated at 6 to 10 people.	A warning system should be provided to warn downstream residents of imminent failure of the dam.

RESERVOIR

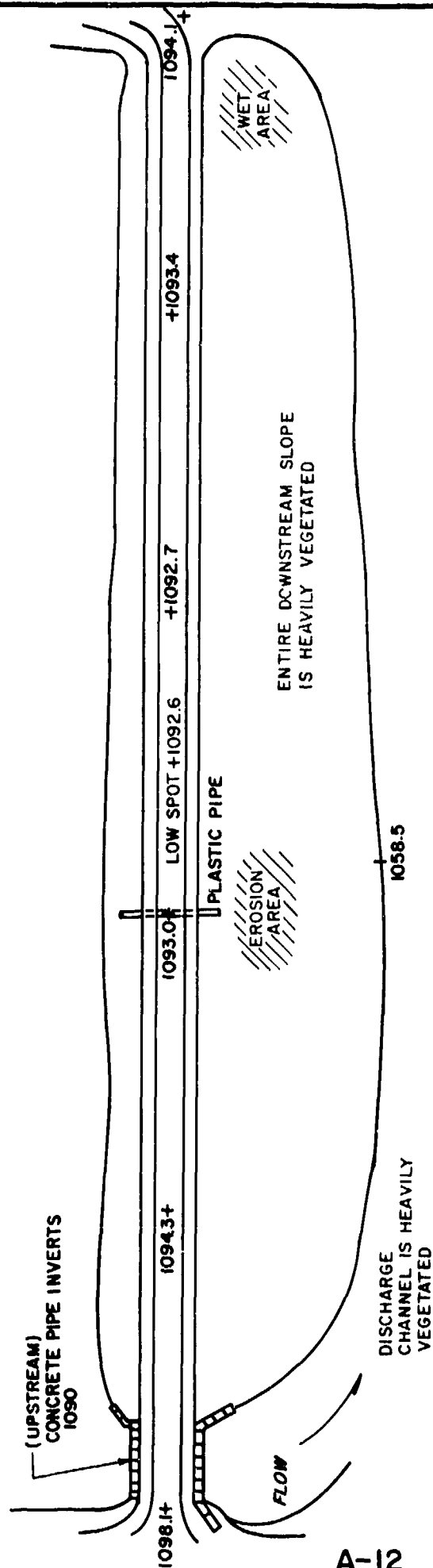
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate.	
SEDIMENTATION	Unknown.	

INSTRUMENTATION

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.		
OBSERVATION WELLS	None.		
WEIRS	None.		
PIEZOMETERS	None.		
OTHER	None.		



POOL
+1088.6



A-12



PATSY'S LAKE DAM
SCALE: 1"=50'

DRY MASONRY
WALL

16

1095.1

1093.6

LOW SPOT
1092.6

1092.8

1093.7

14'

DOWNSTREAM
INVERTS OF
PIPES (1089.0)
(3) 18" PIPES

1058.5

PROFILE
LOOKING UPSTREAM
SCALE: 1"=50'

A-13



PATSY'S LAKE DAM

APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Patsy's Lake Dam

ID# PA 565

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	Limited information provided by the owner.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

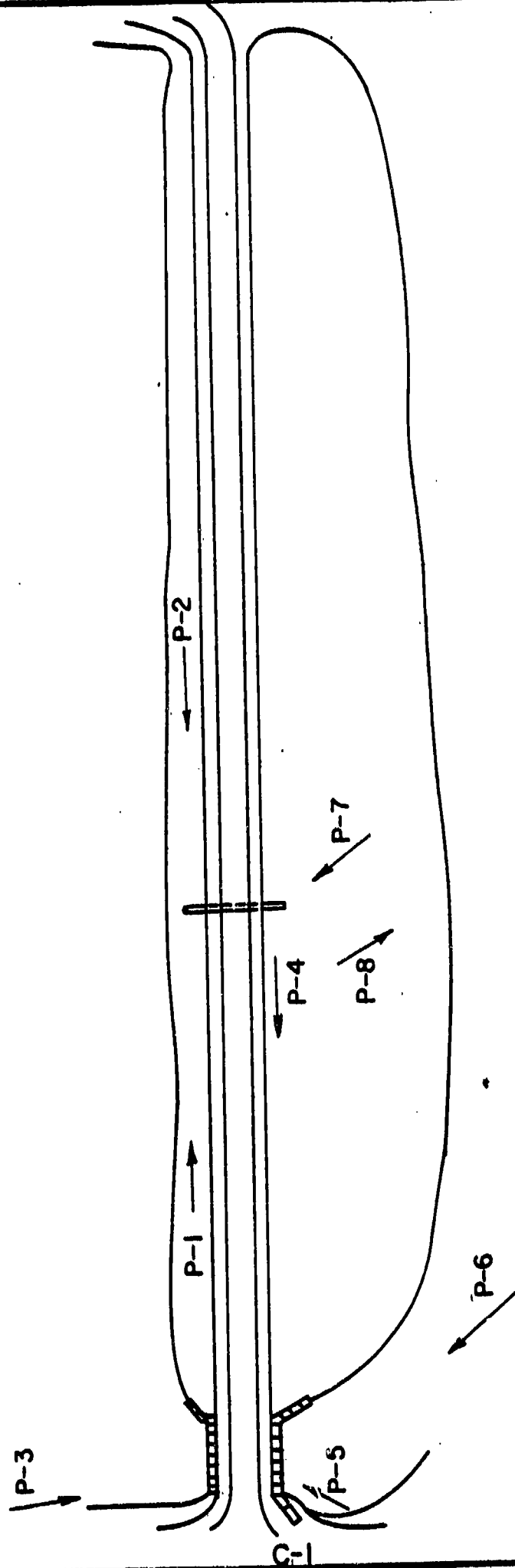
ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None.
POST-CONSTRUCTION SURVEYS OF DAM	None known to have occurred.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	The original spillway was filled, and three 18" diameter pipes placed in the original spillway channel and covered with earthfill.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Dam was reportedly overtopped. The owner could not provide the date associated with the failure. No significant downstream damage reported.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS

PATSY'S LAKE DAM
PHOTO INDEX



P- INDICATES PHOTO LOCATION



PATSY'S LAKE DAM
PA 565

Sheet 1

Front

1. Upper left - View of crest of dam. View towards left abutment.
2. Upper right - View of crest and upstream slope of dam. View towards the right abutment.
3. Lower left - View of spillway approach. Note spillway pipes.
4. Lower right - View of downstream slope near the right abutment contact. View towards the right abutment.

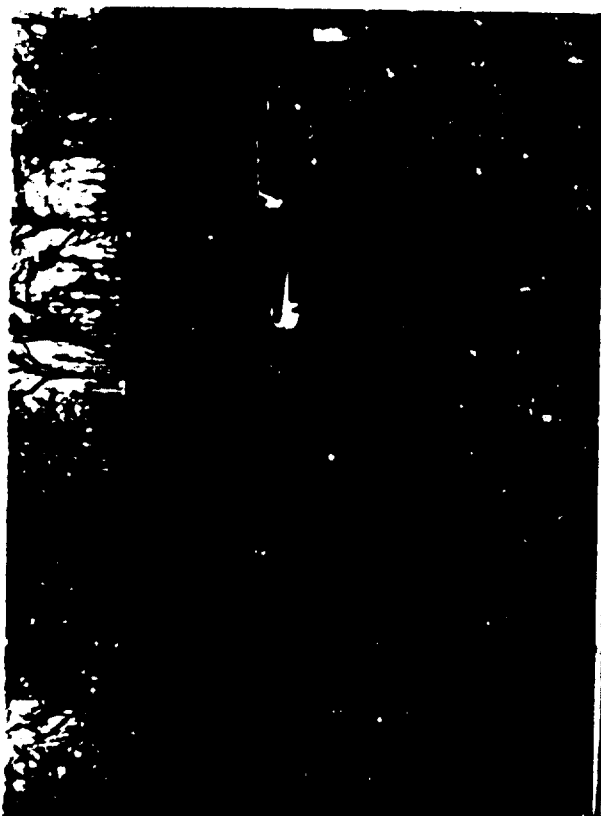
Sheet 1

Back

5. Upper left - View of downstream invert of spillway.
6. Upper right - View of discharge channel. Note dense vegetation in channel.
7. Lower left - View of erosion area near crest on downstream slope of dam. Note plastic pipe on crest and hose utilized to supply water to downstream cleaning plant.
8. Lower right - Downstream exposure. Note homes immediately across township road.

TOP OF PAGE

1,5	2,6
3,7	4,8





APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall may be reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topographic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input, or sufficient dimensions input, and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimeted from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF, the computer program will calculate the percentage of the PMF, which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS DATA BASE

NAME OF DAM: Patsy's Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.4 inches

STATION	1	2	3
---------	---	---	---

Station Description	Patsy's Lake
---------------------	--------------

Drainage Area (square miles)	0.22
---------------------------------	------

Cumulative Drainage Area (square miles)	0.22
--	------

Adjustment of PMF for Drainage Area (%) (1)	(Zone 7)
6 hours	102
12 hours	120
24 hours	130
48 hours	140
72 hours	N/A

Snyder Hydrograph

Parameters	
Zone (2)	29
Cp (3)	0.5
Ct (3)	1.6
L (miles) (4)	0.6
Lca (miles) (4)	0.2
tp = Ct(LxLca) 0.3 hrs.	0.85

Spillway Data

Crest Length (ft)	N/A
Freeboard (ft)	2.6
Discharge Coefficient	N/A
Exponent	N/A

- (1) Hydrometeorological Report 33 (Figure 1), U.S. Weather Bureau and U.S. Army Corps of Engineers, 1956.
- (2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
- (3) Snyder's Coefficients.
- (4) L=Length of longest water course from outlet to basin divide.
Lca=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.22 sq.mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1090.0 [92 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1092.6 [117 ac-ft]

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1092.6 [low spot]

SPILLWAY CREST:

a. Elevation 1090.0 [assumed]

b. Type Three 18" diameter pipes

c. Width Not applicable

d. Length Approximately 20 feet

e. Location Spillover Right abutment

f. Number and Type of Gates None

OUTLET WORKS:

a. Type Not applicable

b. Location Not applicable

c. Entrance inverts Not applicable

d. Exit inverts Not applicable

e. Emergency drawdown facilities Not applicable

HYDROMETEOROLOGICAL GAUGES:

a. Type None

b. Location None

c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

NOTE: Elevations referenced to M.S.L.



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME PATSY'S LAKE DAM
NUMBER PA-565

SHEET NO. 1 OF 4
BY OTM DATE MAY, 1981

LOSS RATE AND BASE FLOW PARAMETERS

STR TL = 1 INCH
CN STL = 0.05 IN/HR
STRTQ = 1.5 cfs/mi²
QRC SN = 0.05 (5% OF PEAK FLOW)
RTIO R = 2.0

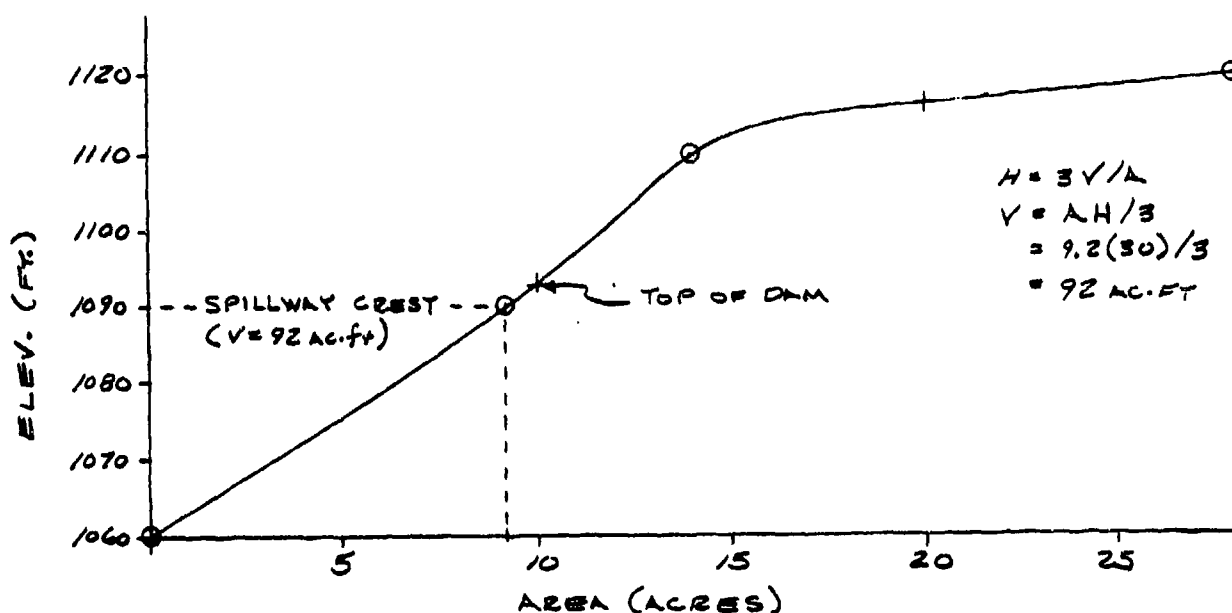
AS RECOMMENDED BY THE BALTIMORE DISTRICT
CORPS OF ENGINEERS.

ELEVATION-AREA-CAPACITY RELATIONSHIPS

FROM U.S.G.S., 7.5-MINUTE QUADRANGLE AND FIELD
INSPECTION DATA.

ASSUME SPILLWAY CREST ELEVATION = 1090.0
ASSUME ZERO STORAGE AT ELEVATION = 1060.0
AREA AT SPILLWAY CREST = 9.2 ACRES

AT ELEV. 1100, AREA = 14 ACRES
AT ELEV. 1120, AREA = 28 ACRES





L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EDENSBURG PENNSYLVANIA

NAME _____

NUMBER _____

PA-565

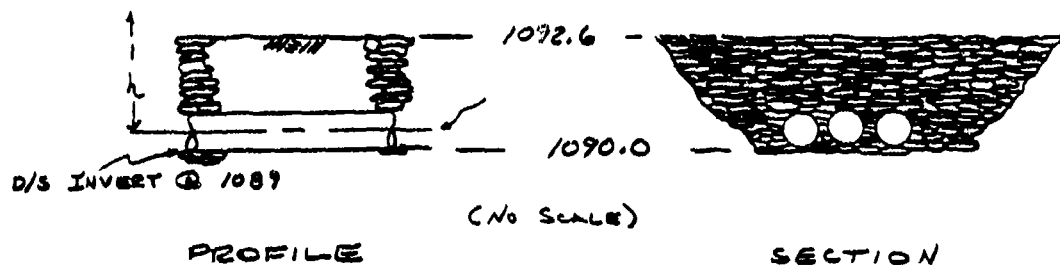
SHEET NO. 2 OF 4

BY OTM DATE MAY, 1981

AREA (AC)	0	9.2	10	14	20	28
ELEV. (FT.)	1060	1090	1092.6	1110	1117	1120

DISCHARGE RATING

SPILLWAY CONSISTS OF THREE (3), 18" Ø PIPES
LOCATED AT THE RIGHT ABUTMENT.



FROM $Q = CA\sqrt{2gh}$

AREA EA. PIPE = $\pi r^2 = \pi (0.75')^2 = 1.8 \text{ FT}^2$

LENGTH OF PIPE $\approx 20'$

(2) 18" Ø STEEL & (1) 18" Ø R.C.P.

ASSUME $C = 0.55$ (AVERAGE FOR ALL 3 PIPES)

$Q_{MAX} = (3) C A \sqrt{2g (1092.6 - 1089.8)}$

$= (3) (0.55) (1.8) \sqrt{(64.4) (2.8)}$

$\approx 40 \text{ cfs}$

OVERTOPPING; $Q = clh^{3/2}$

USE $C = 2.9$ (BROAD CREST)

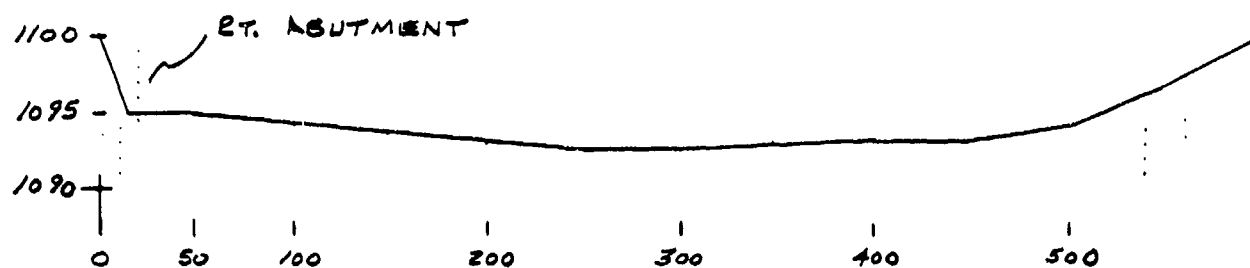
h VARIES WITH l



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EDENSURG PENNSYLVANIA

NAME _____
NUMBER RA-565

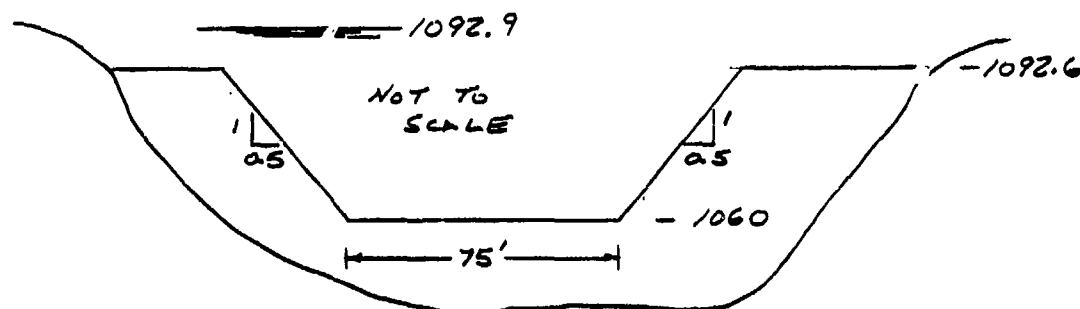
SHEET NO. 3 OF 4
BY OTM DATE MAY, 1981



(TOP OF DAM PROFILE)
VIEWING UPSTREAM

ELEVATION (FT.)	h (FT.)	l (FT.)	DISCHARGE (cfs)
1092.6	0	—	40
1093.0	0.4	250	180
1093.5	0.9	320	790
1094.0	1.4	390	1870
1094.5	1.9	450	3410
1095.0	2.4	510	5500

BREACH ANALYSIS AND FLOOD ROUTING



CONSIDER 0.30' OVERTOPPING SUFFICIENT TO CAUSE
FAILURE OF THE STRUCTURE. RATIO OF PMF = 0.20
BRWID = 75' TFAIL = 2 HRS.
Z = 0.5 WSEL = 1090
ELBM = 1060 FAIL EL = 1092.6



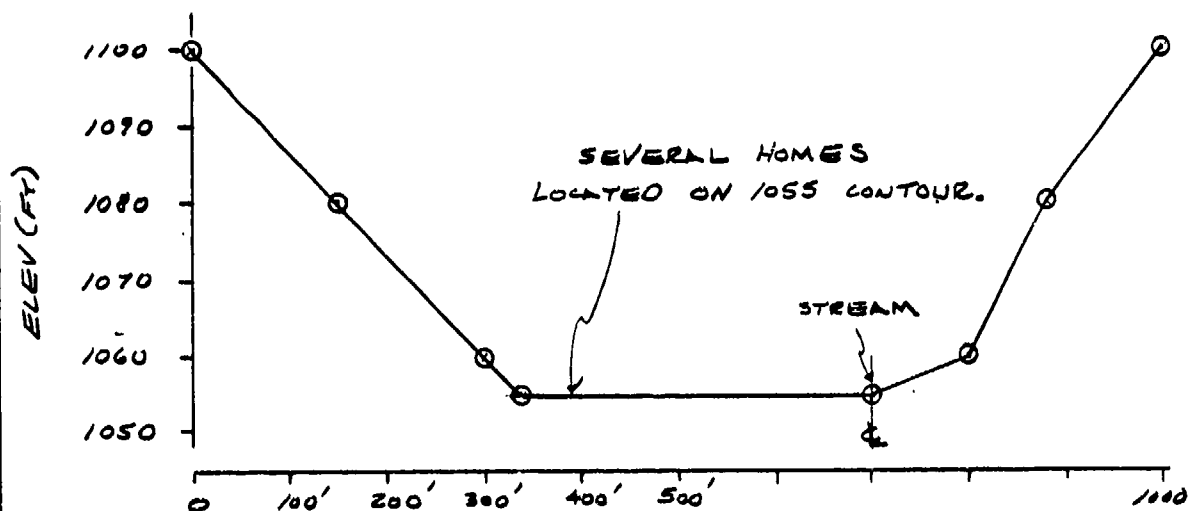
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBensburg PENNSYLVANIA

NAME _____

NUMBER PA-565

SHEET NO. 4 OF 4

BY OTM DATE MAY, 1981



DOWNSTREAM REACH PROFILE
VIEWING DOWNSTREAM

REACH CROSS-SECTION LOCATED APPROXIMATELY
100 FEET BEYOND TOE OF DAM. CROSS-SECTION
DATA FROM U.S.G.S. 7.5-MINUTE QUAD.

CHANNEL MANNING'S (n) ASSUMED TO EQUAL 0.05.
OVERBANK MANNING'S (n) ASSUMED TO EQUAL 0.06.

REACH LENGTH = 300'
AVERAGE SLOPE = 0.10

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 01 APR 80

RUN DATE# 01/05/19.
 TIME# 09.30.05.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF PATSY'S LAKE DAM
 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-5651)

JOB SPECIFICATION
 NO NWR NMIN IDAY IHR IMIN METRC IPLT IPRT NSTAN
 288 0 10 0 0 0 0 -4 0
 JOPER NMT LROPT TRACE
 5 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED

NPLAN= 1 NRATIO= 5 LRTIO= 1

RATIO# 08 10 20 250 1000

***** ***** ***** *****

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUO
 1 0 0 0 0 0 1 0 0

HYDROGRAPH DATA
 IHYDG IUNG TAREA SNAP TRSBA TRSPC RATIO ISNOW ISAME LOCAL
 1 1 22 0.00 22 1.00 0.000 0 1 0

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 24.40 102.00 120.00 130.00 140.00 0.00 0.00

LROPT STKR DLTKR RTIOL ERAIN STRKS \ TOK CNSTL ALSMX RTIMP
 0 0.00 0.00 1.00 0.00 0.00 1.00 .05 0.00 0.00

UNIT HYDROGRAPH DATA

TP= .85 CP= .50 NTA= 0

RECESSION DATA

RTIOR= 2.00

STRTO= -1.50

GRCSN= -.05

UNIT HYDROGRAPH 39 END-OF-PERIOD ORDINATES, LAG= .85 HOURS, CP= .50 VOL= 1.00
 6. 23. 45. 67. 81. 83. 75. 65. 56. 48.
 42. 36. 31. 27. 23. 20. 17. 15. 13. 11.
 9. 8. 7. 6. 5. 5. 4. 3. 3. 3.
 2. 2. 2. 1. 1. 1. 1. 1. 1. 1.

0
NG-DA

HR. MM.	PERIOD	RAIN	EXCS	LOSS
0000	0000	0.0	0.0	0.0
0001	0001	0.0	0.0	0.0
0002	0002	0.0	0.0	0.0
0003	0003	0.0	0.0	0.0
0004	0004	0.0	0.0	0.0
0005	0005	0.0	0.0	0.0
0006	0006	0.0	0.0	0.0
0007	0007	0.0	0.0	0.0
0008	0008	0.0	0.0	0.0
0009	0009	0.0	0.0	0.0
0010	0010	0.0	0.0	0.0
0011	0011	0.0	0.0	0.0
0012	0012	0.0	0.0	0.0
0013	0013	0.0	0.0	0.0
0014	0014	0.0	0.0	0.0
0015	0015	0.0	0.0	0.0
0016	0016	0.0	0.0	0.0
0017	0017	0.0	0.0	0.0
0018	0018	0.0	0.0	0.0
0019	0019	0.0	0.0	0.0
0020	0020	0.0	0.0	0.0
0021	0021	0.0	0.0	0.0
0022	0022	0.0	0.0	0.0
0023	0023	0.0	0.0	0.0
0024	0024	0.0	0.0	0.0
0025	0025	0.0	0.0	0.0
0026	0026	0.0	0.0	0.0
0027	0027	0.0	0.0	0.0
0028	0028	0.0	0.0	0.0
0029	0029	0.0	0.0	0.0
0030	0030	0.0	0.0	0.0
0031	0031	0.0	0.0	0.0
0032	0032	0.0	0.0	0.0
0033	0033	0.0	0.0	0.0
0034	0034	0.0	0.0	0.0
0035	0035	0.0	0.0	0.0
0036	0036	0.0	0.0	0.0
0037	0037	0.0	0.0	0.0
0038	0038	0.0	0.0	0.0
0039	0039	0.0	0.0	0.0
0040	0040	0.0	0.0	0.0
0041	0041	0.0	0.0	0.0
0042	0042	0.0	0.0	0.0
0043	0043	0.0	0.0	0.0
0044	0044	0.0	0.0	0.0
0045	0045	0.0	0.0	0.0
0046	0046	0.0	0.0	0.0
0047	0047	0.0	0.0	0.0
0048	0048	0.0	0.0	0.0
0049	0049	0.0	0.0	0.0
0050	0050	0.0	0.0	0.0
0051	0051	0.0	0.0	0.0
0052	0052	0.0	0.0	0.0
0053	0053	0.0	0.0	0.0
0054	0054	0.0	0.0	0.0
0055	0055	0.0	0.0	0.0
0056	0056	0.0	0.0	0.0
0057	0057	0.0	0.0	0.0
0058	0058	0.0	0.0	0.0
0059	0059	0.0	0.0	0.0
0060	0060	0.0	0.0	0.0
0061	0061	0.0	0.0	0.0
0062	0062	0.0	0.0	0.0
0063	0063	0.0	0.0	0.0
0064	0064	0.0	0.0	0.0
0065	0065	0.0	0.0	0.0
0066	0066	0.0	0.0	0.0
0067	0067	0.0	0.0	0.0
0068	0068	0.0	0.0	0.0
0069	0069	0.0	0.0	0.0
0070	0070	0.0	0.0	0.0
0071	0071	0.0	0.0	0.0
0072	0072	0.0	0.0	0.0
0073	0073	0.0	0.0	0.0
0074	0074	0.0	0.0</	

END-OF--PERIOD	MO. DA	HR. MIN
COMP Q		

	RAIN	EXCS	LOSS
1	100	100	100
2	100	100	100
3	100	100	100
4	100	100	100
5	100	100	100
6	100	100	100
7	100	100	100
8	100	100	100
9	100	100	100
10	100	100	100
11	100	100	100
12	100	100	100
13	100	100	100
14	100	100	100
15	100	100	100
16	100	100	100
17	100	100	100
18	100	100	100
19	100	100	100
20	100	100	100
21	100	100	100
22	100	100	100
23	100	100	100
24	100	100	100
25	100	100	100
26	100	100	100
27	100	100	100
28	100	100	100
29	100	100	100
30	100	100	100
31	100	100	100
32	100	100	100
33	100	100	100
34	100	100	100
35	100	100	100
36	100	100	100
37	100	100	100
38	100	100	100
39	100	100	100
40	100	100	100
41	100	100	100
42	100	100	100
43	100	100	100
44	100	100	100
45	100	100	100
46	100	100	100
47	100	100	100
48	100	100	100
49	100	100	100
50	100	100	100
51	100	100	100
52	100	100	100
53	100	100	100
54	100	100	100
55	100	100	100
56	100	100	100
57	100	100	100
58	100	100	100
59	100	100	100
60	100	100	100
61	100	100	100
62	100	100	100
63	100	100	100
64	100	100	100
65	100	100	100
66	100	100	100
67	100	100	100
68	100	100	100
69	100	100	100
70	100	100	100
71	100	100	100
72	100	100	100
73	100	100	100
74	100	100	100
75	100	100	100
76	100	100	100
77	100	100	100
78	100	100	100
79	100	100	100
80	100	100	100
81	100	100	100
82	100	100	100
83	100	100	100
84	100	100	100
85	100	100	100
86	100	100	100
87	100	100	100
88	100	100	100
89	100	100	100
90	100	100	100
91	100	100	100
92	100	100	100
93	100	100	100
94	100	100	100
95	100	100	100
96	100	100	100
97	100	1	

CONFIDENTIAL

SUM	34.16	31.68	2.48	26612.0
	(.8680)	(.8050)	.6301	753.571

● ● ● ● ● ● ● ● ● ●

卷之四

新華書店發行

●●●●●●●●

蘇州府志

HYDROGRAPH ROUTING

ROUTE

ISTAG	ICOMP	IECON	ITAPE	JPLY	JPR1	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IPRES	ISAME	IORT	IPMP	LBIN
9.0	0.000	0.00	1	1	0	0	

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0,000	0.000	0,000	-1090.	-1

[illegible]

FLOW

SURFACE AREA=

CAPACITY=

ELEVATION=

CREL	SPVID	COOM	EXPM	ELEV	COOL	CAREA	EXPL
1090.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA			
TOPEL	ZOOD	EXPD	DAMWID
1092.6	0.0	0.0	0.0

PEAK OUTFLOW IS 17. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 33. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 153. AT TIME 41.17 HOURS

PEAK OUTFLOW IS 469. AT TIME 40.50 HOURS

PEAK OUTFLOW IS 947. AT TIME 40.50 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS				
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5
				.05	.10	.20	.50	1.00
HYDROGRAPH AT	1	.22 (.57)	1	.47	.99	190.	474.	949.
				1.32	2.69	5.37	13.43	26.86
ROUTED TO	2	.22 (.57)	1	.17	.33	153.	469.	947.
				.47	.92	4.32	13.27	26.83

SUMMARY OF DA: SAFETY ANALYSIS

PLAN 1

ELEVATION
STORAGE
OUTFLOW

INITIAL VALUE
1090.00
92.
0.

SPILLWAY CREST
1090.00
92.
0.

TOP OF DAM
1092.60
117.
40.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1091.07	0.00	102.	17.	0.00	43.00	0.00
.10	1092.12	0.00	112.	33.	0.00	43.00	0.00
.20	1092.92	.32	120.	153.	3.67	41.77	0.00
.50	1093.24	.64	123.	469.	7.50	40.50	0.00
1.00	1093.57	.97	127.	947.	12.00	40.50	0.00

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1979
LAST MODIFICATION 01 APR 80

RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
DOWNSTREAM CONDITIONS DUE TO OVERTOPPING OF PATSY'S LAKE
PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH (PA-565)

	A1	A2	A3	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	JJ	JK	JL	JM	JN	JO	JP	JQ	JR	JS	JT	JU	JV	JW	JX	JY	JZ	KA	KB	KC	KD	KE	KF	KG	KH	KI	KJ	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	JJ	JK	JL	JM	JN	JO	JP	JQ	JR	JS	JT	JU	JV	JW	JX	JY	JZ	KA	KB	KC	KD	KE	KF	KG	KH	KI	KJ	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	JJ	JK	JL	JM	JN	JO	JP	JQ	JR	JS	JT	JU	JV	JW	JX	JY	JZ	KA	KB	KC	KD	KE	KF	KG	KH	KI	KJ	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL</
--	----	----	----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------

PEAK FLOW AND STORAGE TEND OF PERIOD SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO	1	20
HYDROGRAPH AT	1	.22	1	190.		
	(.57)	(5.3711		
	2		2	190.		
	((5.3711		
ROUTED TO	2	.22	1	2003.		
	(.57)	(56.7311		
	2		2	153.		
	((4.3211		
ROUTED TO	3	.22	1	2002.		
	(.57)	(56.6911		
	2		2	153.		
	((4.3211		

10/0

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1090.00	1090.00	1092.60	
STORAGE	92.	92.	117.	
OUTFLOW	0.	0.	40.	

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1092.92	.32	120.	2004.	.96	41.79	41.00

PLAN 2		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1090.00	1090.00	1092.60	
STORAGE	92.	92.	117.	
OUTFLOW	0.	0.	40.	

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1092.92	.32	120.	153.	3.67	41.17	0.00

18

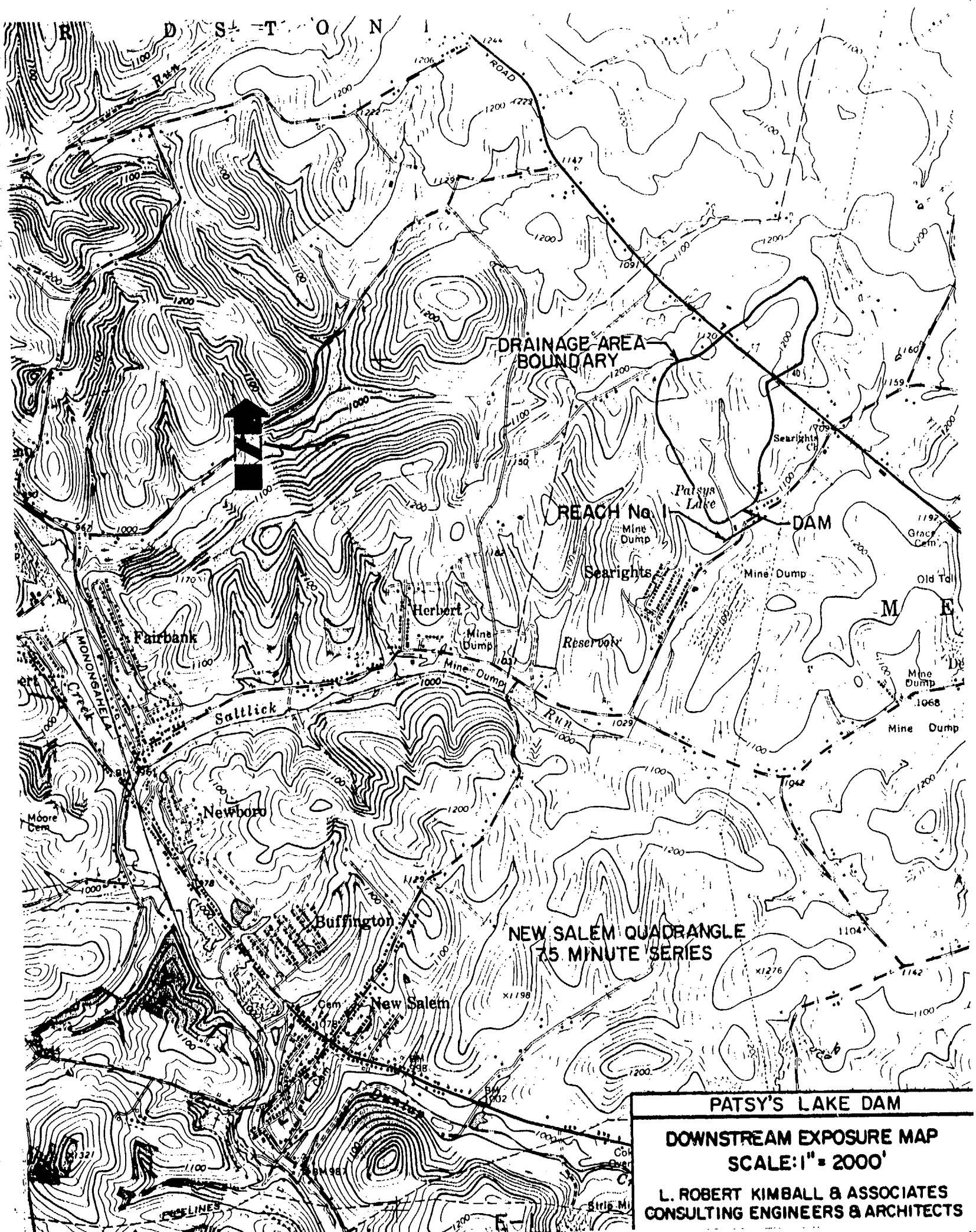
PLAN 1		STATION
--------	--	---------

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.20	2002.	1055.3	41.03

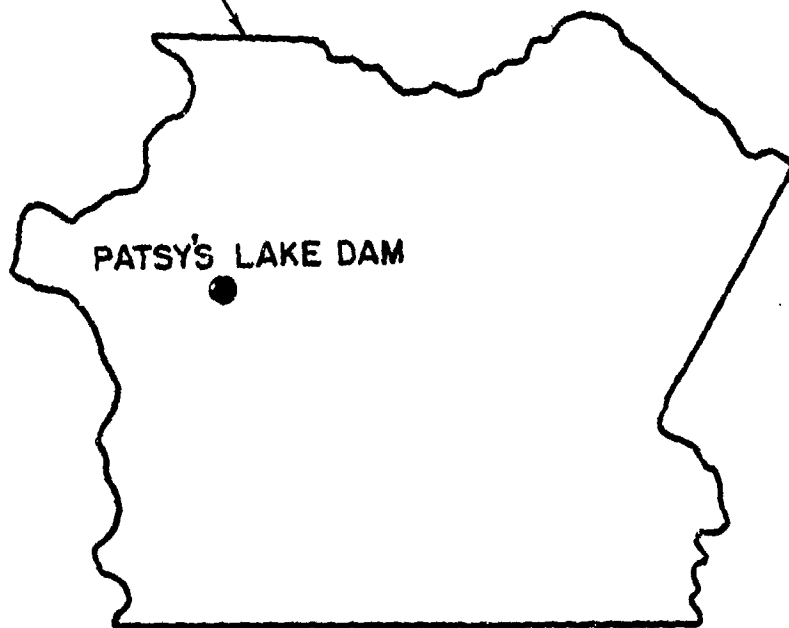
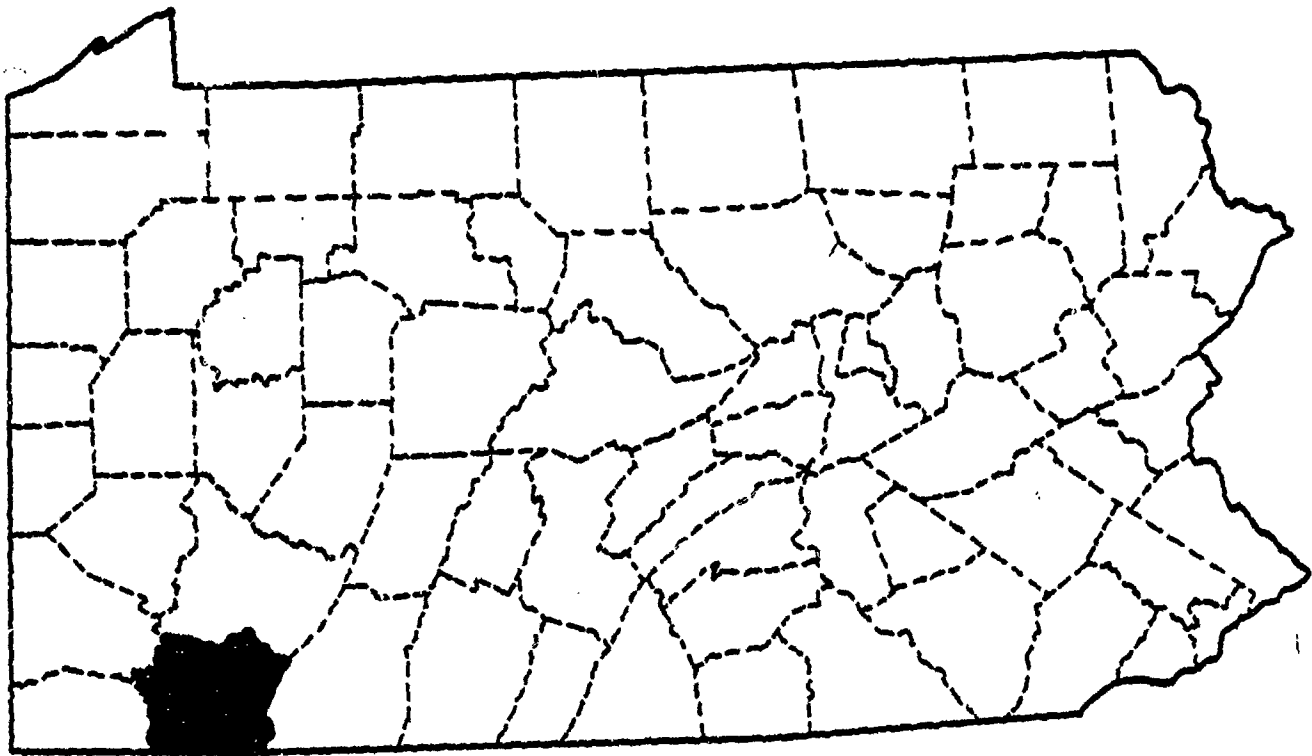
PLAN 2		STATION
--------	--	---------

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.20	153.	1055.0	41.17

APPENDIX E
DRAWINGS



PATSY'S LAKE DAM
DOWNSTREAM EXPOSURE MAP
SCALE: 1" = 2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



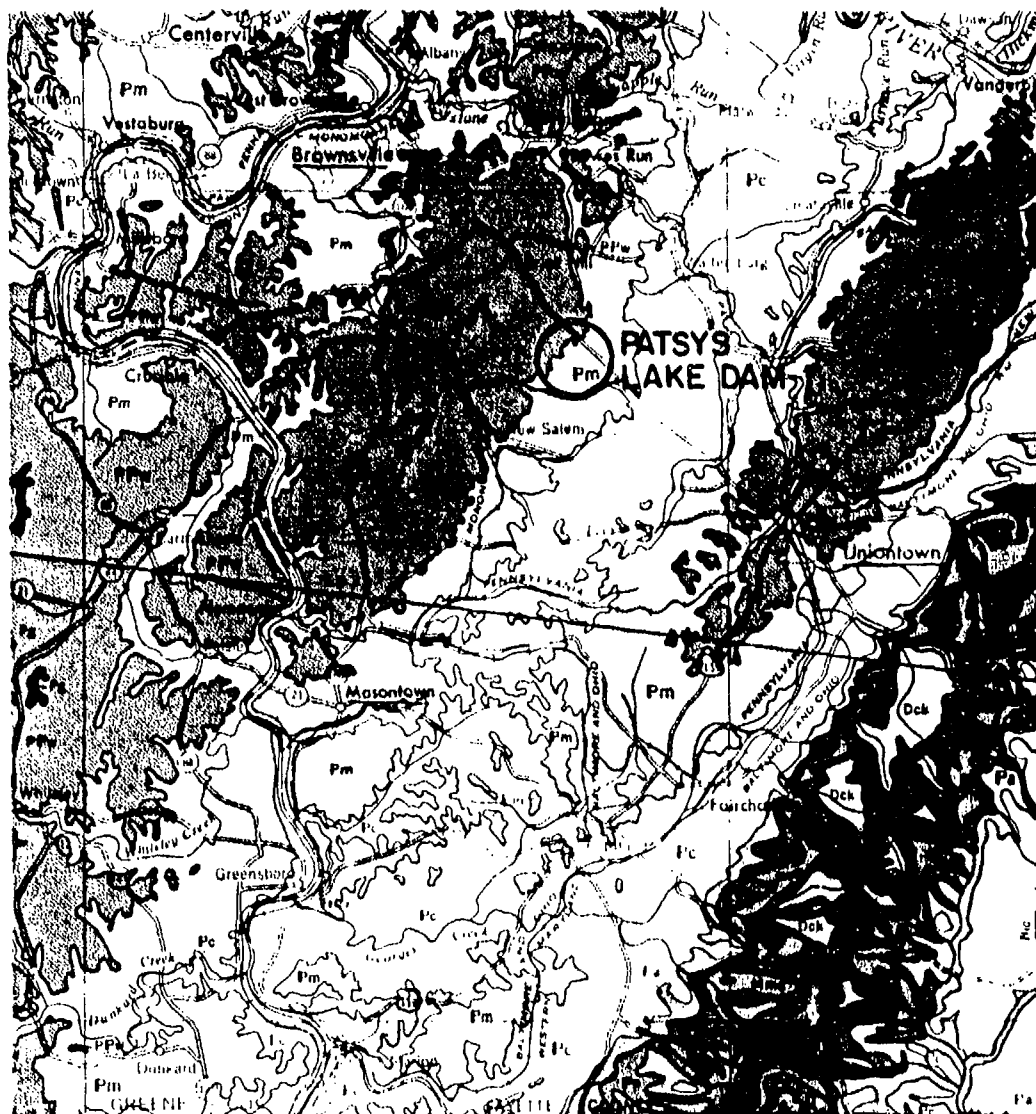
SITE LOCATION MAP
FAYETTE COUNTY, PENNSYLVANIA

APPENDIX F
GEOLOGY

General Geology

The Patsy's Lake Dam is located in the Pittsburgh Plateaus Section of the Appalachian Plateau Province. The topography of this section is composed of more or less elevated plateaus, broken by a few ridges, where minor folds have affected the rocks, and is greatly dissected by streams. The strata are deformed by several sub-parallel secondary folds which are superimposed upon a broad, flat, canoe-shaped trough of first magnitude in southwestern Pennsylvania and adjacent regions. The axes of these folds trend northeast, plunging gently southward. The Patsy's Lake Dam lies on the common limb of the Lambert Syncline and Fayette Anticline, both of whose axes strike about N22°E. Therefore, the dam is underlain by rock which strikes about N22°E and dips gently to the northwest.

The bedrock underlying the dam and exposed in the nearby vicinity consists of shale, limestone and occasionally coarse sandstone belonging to the Monongahela Formation of Upper Pennsylvanian Age. This formation extends from the Pittsburgh coal at its base to the Waynesburg coal at the top, and ranges in thickness from 370-400 feet. The Pittsburgh coal seam is about 275 feet beneath the surface in this area. The seam averages between 8 and 11 feet thick and has been mined out beneath the study area (1974).



GEOLOGIC MAP OF THE AREA AROUND PATSY'S LAKE DAM
SCALE 1:250,000

PERMIAN AND PENNSYLVANIAN

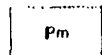


Washington Formation

Cyclic sequences of sandstone, shale, limestone and coal, some red shale, some micaceous coal, base at the top of the Wagnerburg Coal

PENNSYLVANIAN

APPALACHIAN PLATEAU



Monongahela Formation

Cyclic sequences of limestone, shale, limestone and coal, limestone increases in northern outcrop areas, shale and sandstone increase southward, commercial coals present, base at the bottom of the Pittsburgh Coal



Conemaugh Formation

Cyclic sequences of red and gray shales and sandstones with thin limestones and some massive Mahoning Sandstone, concretionary present at base, lower limestones present in the section, Beach Creek limestones occur part of section